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## PATENT ABSTRACTS OF JAPAN

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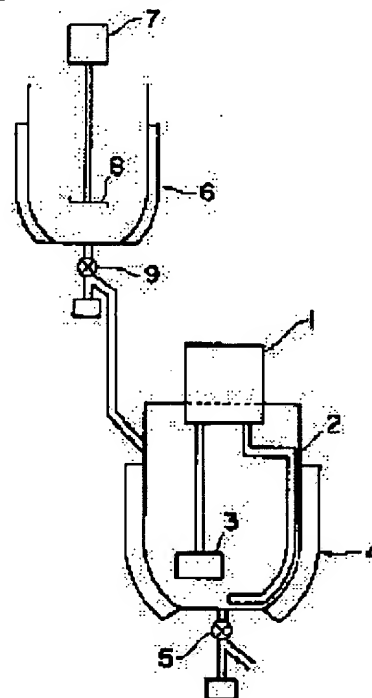
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### (54) MANUFACTURE OF NEGATIVE ELECTRODE MIX OF NONAQUEOUS SECONDARY BATTERY

#### (57)Abstract:

PURPOSE: To provide a nonaqueous-secondary-battery negative electrode mix which is high in viscosity and contains almost no aggregates by kneading and dispersing together a negative active material, a conducting agent, and a dispersion in which a binder is dispersed in a thickener solution.

CONSTITUTION: Water and carboxymethyl cellulose CMC are put in a predispersion tank 6 and then the dispersing agitating blade 8 of an agitator 7 is rotated to dissolve the CMC in the water. Polyvinylidene fluoride is put in this solution, and the dispersing agitating blade 8 of the agitator 7 is rotated to prepare a dispersion of polyvinylidene fluoride. The dispersion is transferred to a dispersion tank 4, SiSnO<sub>3</sub>, acetylene black and graphite are added, and the dispersing agitating blade 3 and the anchor blade 2 of an agitator 1 are rotated to obtain a negative electrode mix. Thus aggregates such as binder aggregate and carbon aggregate in the negative electrode mix can be markedly reduced without the viscosity of the negative electrode mix being lowered.



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**DETAILED DESCRIPTION**

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[Detailed description]

[0001]

[Field of the Invention] this invention -- the object for the negative electrodes of a non-water rechargeable battery -- it is related with the manufacture technique of a mixture

[0002]

[Prior art] As a rechargeable battery, alkaline batteries, such as a lead accumulator and nickel-cadmium system, are known from the former. Recently, the non-water rechargeable battery (lithium secondary battery) attracts attention as a rechargeable battery of a high-energy density and high-energy luminous efficacy further.

[0003] In the non-water rechargeable battery, the lithium metal and the lithium alloy are typical as a negative-electrode active material. in order [ in this case, ] to mainly use a lithium metal for a negative electrode -- a negative electrode -- although there is no need for a manufacture of a mixture -- a positive electrode -- it is necessary to manufacture a mixture a positive electrode -- positive active materials, such as the manganese dioxide powder, and the electric conduction agent of acetylene black powder and graphite powder are added to the thickener aqueous solutions, such as polyvinyl alcohol (PVA), and it mixes, usually, a mixture is thrown in in a kneader, is mulled, adds binding agents, such as a polytetrafluoroethylene dispersion, in the obtained mulling object, mulls them again, and the vacuum deairing of it is carried out and it is manufactured after adding an active material, and an electric conduction agent and a binding agent to the thickener solution which added the surfactant and the defoaming agent in the Provisional-Publication-No. 236258 [ 63 to ] official report as other technique -- mulling -- a positive electrode -- the method of manufacturing a mixture is indicated furthermore -- a publication-number 32067 [ one to ] official report -- a positive active material, an electric conduction agent, and a thickener -- beforehand -- blending dryly -- after that -- this mixture -- a diluent and a binding agent -- separate -- or -- together -- adding -- mulling -- a positive electrode -- the method of manufacturing a mixture is indicated

[0004] In the non-water rechargeable battery which uses a lithium metal and a lithium alloy as a negative-electrode active material, the activity of the arborescence metal [ itself ] is high in a lithium metal's growing up to be an arborescence and carrying out internal short-circuit into charge and discharge, and risk of igniting is conceived. On the other hand, an occlusion, and the metallic compounds and the carbonaceous material which can be emitted have come to be put in practical use in the lithium which avoided such danger recently. the negative electrode of the non-water rechargeable battery in the case of using metallic compounds and a carbonaceous material as a negative-electrode active material -- a mixture is obtained by distributing a negative-electrode active material etc. in a binding agent like the above For example, as a negative-electrode active material, a scale-like graphite (electric conduction agent), and a binding agent, the mixture which carried out the mixed variance of a polyvinylidene fluoride and the solvent is used, and the negative-electrode sheet is produced (an example, publication-number 265167 [ two to ] official report).

[0005]

[Object of the Invention] the object for the negative electrodes of the non-water rechargeable battery obtained by adding to a solvent and carrying out the mulling variance of a negative-electrode active material, an electric conduction agent, and the binding agent by study of this invention person -- the mixture was applied to the separator and it became clear that occurrence of the paint film defect by the case where a big and rough aggregate remains, and defluxion of an aggregate is shown in the front face of the negative-electrode sheet which performs press processing by the roller and is obtained and this -- the object for negative electrodes -- a mixture -- it also became clear to originate in the aggregate of the electric conduction agent which exists in inside, or a binding agent Since according to the study of this invention person viscosity tends to have fallen when it adds to a solvent and the mulling variance of a negative-electrode active material, an electric conduction agent, and the binding agent is carried out, it became clear that the above-mentioned aggregate occurs. That is, since mulling variance sufficient in the status that viscosity fell cannot be performed, after a viscosity down is for the distributed status to hardly good-ize. That the good distributed status is acquired found the binding agent of this invention by the distributed \*\*\*\* technique in the thickener solution beforehand, without carrying out a viscosity down.

[0006] a negative-electrode active material, an electric conduction agent, and a binding agent distribute the purpose of this invention uniformly -- having -- hyperviscosity -- it is -- the object for the negative electrodes of the non-water rechargeable battery which does not almost have an aggregate -- it is in offering the technique of manufacturing a mixture

[0007]

[The means for solving a technical problem] the object for the negative electrodes of the non-water rechargeable battery which consists of the above-mentioned purpose carrying out the mulling variance of a negative-electrode active material and an electric conduction agent, and the distributed liquid that the binding agent distributed in the thickener solution -- it can attain by the manufacture technique of a mixture. The desirable mode of the above-mentioned manufacture technique of this invention is as follows.

1) The above-mentioned manufacture technique that the solvent of a thickener solution is water.

2) The above-mentioned manufacture technique that a binding agent is a fluororesin.

3) The above-mentioned manufacture technique that a thickener is a carboxymethyl cellulose.

[0008] 5) The above-mentioned manufacture technique that a thickener solution is a solution in which the thickener was melted at a rate of 0.1 - 5.0 weight section to the solvent 100 weight section.

6) General formula of the following [ active material / negative-electrode ] (II): MBm ... (II)

M is [ , however the above-mentioned manufacture technique which is the compound expressed [ express / a kind / at least ] with] which is chosen out of the group which is chosen out of Si, germanium, Sn, Pb, Bi, Sb, P, B, and the group that consists of aluminum and As, and which B becomes from O, S, Se, and Te, and which m has in the domain of 1-10 by expressing a kind at least.

7) The above-mentioned manufacture technique that a binding agent is a polyvinylidene fluoride.

8) The above-mentioned manufacture technique that electric conduction arrival agents are natural graphites (a flaky graphite, a scale-like graphite, earthy graphite, etc.), an artificial graphite, carbon black, and/or acetylene black.

[0009] the negative electrode used in order that the manufacture technique of this invention may form the negative electrode containing the negative-electrode active material of the non-water rechargeable battery which consists of nonaqueous electrolyte containing a positive active material, a negative-electrode active material, and lithium salt -- it is the manufacture technique of a mixture. The example of the manufacture technique of this invention is explained, referring to drawing 1 . In the pre variance tank 6, a thickener distributes by supplying the solution and binding agent which melted into the solvent(water), and subsequently rotating the stirring airfoil 8 for variance of the stirring machine 7 (pre variance). Generally stirring is performed for 60 - 120 minutes. Generally distributed liquid has the viscosity of 100 - 1000mPa and S (25 degrees C). A bulb 9 is opened and the obtained distributed liquid is sent in the distributed tank 6. Furthermore, a negative-electrode active material and an electric conduction agent are supplied in the distributed tank 6, subsequently the stirring airfoil 4 and the support airfoil 2 for variance of the stirring machine 1 are rotated, and mulling variance is performed. Generally stirring is performed for 20 - 120 minutes. The obtained distributed liquid (negative electrode mixture) opens a bulb 5, and is taken out. Generally distributed liquid has the viscosity of 100 - 1000mPa and S (25 degrees C).

[0010] Generally as a solvent, water is used. As a thickener melted in a solvent, water soluble resins, such as a carboxymethyl cellulose and polyvinyl alcohol, are used. As for the thickener solution which the binding agent distributed, it is desirable that 0.5 - 5% of the weight of the domain (1 - 3 more% of the weight of domain) and the binding agent are contained for the thickener to a solvent to a solvent in 0.1 - 10% of the weight of the domain (2 - 8 more% of the weight of domain). Moreover, the viscosity of the thickener solution which the binding agent distributed has desirable 50 - 1000mPa and S (still preferably 100 - 500mPa and S) at 25 degrees C.

[0011] As a binding agent distributed beforehand, the following can be mentioned into the above-mentioned thickener solution. As a binding agent, kinds or such mixture can be used for the polymer which has polysaccharide, thermoplastics, and rubber elasticity. For example, the polymer, the polyester, the polyurethane, the polyether, the polyamide, the poly-urea, the polyurethane, the polysiloxane, the polycarbonate, the epoxy resin, the phenol resin, the celluloses, the saccharide, and saccharide derivative of an ethylene nature unsaturation monomer can be mentioned. As a desirable example, a polytetrafluoroethylene, a polyvinylidene fluoride, A tetrafluoroethylene / hexafluoropropylene copolymer, polyethylene, Polypropylene, ethylene/propylene / annular diene polymer (EPDM), Styrene / butadiene copolymer (SBR), a polymethyl methacrylate, Polyvinyl acetate, a polyacrylic acid, polyvinyl alcohol, a polyvinyl pyrrolidone, The polymethyl vinyl ether, a polyacrylamide, polyhydroxyethyl methacrylate, A polyethylene horse mackerel peat, a polyvinyl acetal, a polyvinyl butyral (polymer of an above ethylene nature unsaturation monomer), Hexamethylene di-isocyanate / butanediol condensation product (above polyurethane), Hexamethylene di-isocyanate / hexamethylenediamine condensation product (above poly urea), A polyethylene oxide, a polypropylene oxide (above polyether), A poly-dimethyl siloxane (above polysiloxane), bisphenol A / epichlorohydrin addition polymer (above epoxy resin), A phenol / formalin condensation product (above phenol resin), an alginic acid, A chitin, chitosan, agarose, gelatin (an above saccharide and saccharide derivative) and a carboxymethyl cellulose, cellulose acetate, and hydroxypropylcellulose (above celluloses) can be mentioned. It is good at the copolymer of the monomer which constitutes the example of a polymer of the above-mentioned ethylene nature unsaturation monomer besides the above, and other monomers. Moreover, two or more sorts may be mixed and the above-mentioned binding agent may be used, even if it uses it independently. The gestalt at the time of addition into the solvent of a binding agent may be any of powder, a solution, and a distributed object (a dispersion, emulsion). the addition of a binding agent -- a mixture -- 0.1 - 20 % of the weight is desirable to a total weight, and 0.5 - 10 % of the weight is especially desirable the above-mentioned polymer -- a positive electrode -- it can be come together and used for choosing suitably also as a binding agent for mixtures a negative electrode -- especially as a binding agent for mixtures, it is desirable to use fluororesins, such as a polytetrafluoroethylene, a polyvinylidene fluoride, and a tetrafluoroethylene / hexafluoropropylene copolymer

[0012] In the solvent containing the above-mentioned binding agent, a negative-electrode active material and an electric

conduction agent are distributed. The electrode active material (a negative-electrode active material and positive active material) used by this invention is H<sup>+</sup>, Li<sup>+</sup>, Na<sup>+</sup>, and K<sup>+</sup>. The oxide which is mainly concerned with the semimetal of a transition-metals oxide, transition-metals chalcogenide, a carbonaceous material, the periodic table IVB, or VB group can be mentioned that what is necessary is just the compound which can be inserted and (occlusion) emitted. The oxide which is mainly concerned with the semimetal of a lithium inclusion transition-metals oxide, a transition-metals oxide, a carbonaceous material, the periodic table IVB, or VB group especially can be mentioned (as transition metals, Mn, Co, nickel, V, and Fe are desirable, and germanium, Sn, Pb, Bi, and Si are desirable as a semimetal of the periodic table IVB or VB group).

[0013] The compound which is mainly concerned with the semimetal of a carbonaceous material and the periodic table IVB, or VB group as a negative-electrode active material is desirable. As a carbonaceous material, it sets with an X-ray diffraction spectrum, and, for the spacing of the 002nd page, a density is 3 1.1-1.7g/cm at 3.35 - 3.80\*\*. A material is desirable, for example, can mention a graphite, petroleum coke, cresol resin baking carbon, furan-resin baking carbon, polyacrylonitrile fiber baking carbon, vapor-growth carbon, and \*\*\*\*\* baking carbon. As a compound which is mainly concerned with the semimetal of the periodic table IVB or VB group SnO, SnO<sub>2</sub>, GeO, GeO<sub>2</sub>, SnS, and Li<sub>2</sub> SnO<sub>3</sub>, SiSnO<sub>3</sub>, SiGeO<sub>3</sub>, SiPbO<sub>3</sub>, and SnSiO<sub>2</sub> germanium0.1 O<sub>3</sub>, SnSiO<sub>2</sub> germanium0.2 O<sub>3</sub> and SnSiO<sub>2</sub> germanium0.5 O<sub>3</sub>, SnSiO<sub>2</sub> Pb0.1 O<sub>3</sub> and SnSiO<sub>2</sub> Pb0.2 O<sub>3</sub>, SnSiO<sub>2</sub> Pb0.5 O<sub>3</sub> and SnGeO<sub>2</sub> SiO<sub>2</sub> 1 O<sub>3</sub>, SnGeO<sub>2</sub> SiO<sub>2</sub> 2 O<sub>3</sub> and SnPbO<sub>2</sub> SiO<sub>2</sub> 1 O<sub>3</sub>, SnPbO<sub>2</sub> SiO<sub>2</sub> 2 O<sub>3</sub> and SnSiO<sub>2</sub> Pb0.1 germanium0.1 O<sub>3</sub>, SnSiO<sub>2</sub> Pb0.2 O<sub>3</sub> 1 and SnSiO<sub>2</sub> Pb0.2 aluminum0.2 O<sub>3</sub> 4, SnSiO<sub>2</sub> Pb0.4 O<sub>3</sub> 2 and SnSiO<sub>2</sub> Pb0.4 aluminum0.2 O<sub>3</sub> 5, SnSiO<sub>2</sub> Pb0.4 Sb0.1 O<sub>3</sub> 25, SnSiO<sub>2</sub> Pb0.2 germanium0.1 aluminum0.1 O<sub>3</sub> 05, SnP<sub>2</sub> O<sub>7</sub>, and SnP<sub>2</sub> aluminum0.2 O<sub>7</sub> 3 And SnSiO<sub>2</sub> Pb0.8 aluminum0.2 O<sub>3</sub> 7 It can mention.

[0014] A negative-electrode active material is the following general formula (II) : MBm ... (II)

A kind is expressed at least, a kind is expressed at least and, as for [, however M, it is desirable that it is the compound expressed with] which is chosen out of the group which is chosen out of Si, germanium, Sn, Pb, Bi, Sb, P, B, and the group that consists of aluminum and As, and which B becomes from O, S, Se, and Te, and which m has in the domain of 1-10. As a good better compound, the thing of the example of the compound which is mainly concerned with the semimetal of the above-mentioned periodic table IVB or VB group can be mentioned.

[0015] As a positive active material, a lithium inclusion transition-metals oxide and a transition-metals oxide are desirable. in addition, as the example LiCoO<sub>2</sub>, LiNiO<sub>2</sub>, and LiCo<sub>0.5</sub> nickel0.5 O<sub>2</sub>, LiMn<sub>2</sub> O<sub>4</sub>, LiCoVO<sub>4</sub>, LiNiVO<sub>4</sub>, and LiCo<sub>0.9</sub> Sn<sub>0.1</sub>O<sub>2</sub>, LiCo<sub>0.9</sub> Ti<sub>0.1</sub> O<sub>2</sub> and LiCo<sub>0.9</sub> aluminum0.1 O<sub>2</sub>, LiCo<sub>0.9</sub> In<sub>0.1</sub> O<sub>2</sub>, LiCo<sub>0.9</sub> Y<sub>0.1</sub> O<sub>2</sub>, LiCo<sub>0.9</sub> Ce<sub>0.1</sub> O<sub>2</sub>, Fe<sub>3</sub> O<sub>4</sub>, V<sub>6</sub> O<sub>13</sub>, and V<sub>2</sub> O<sub>5</sub> It can mention.

[0016] a negative electrode -- in addition to a binding agent and a negative-electrode active material, to a mixture, an electric conduction agent (it is a filler etc. by request) can be added a positive electrode -- in a mixture, it can manufacture similarly In the constituted cell, if an electric conduction agent is an electronic-conduction nature material which does not cause a chemical change, it is good anything. Usually, conductive materials, such as natural graphites (a flaky graphite, a scale-like graphite, earthy graphite, etc.), an artificial graphite, carbon black, acetylene black, \*\*\*\*\* black, carbon fiber metallurgy group powder (copper, nickel, aluminum, silver (Provisional-Publication-No. 148554 [ 63 to ] official report), etc.), a metal fiber, or a polyphenylene derivative (Provisional-Publication-No. 20971 [ 59 to ] official report), can be included as one sort or such mixture. Especially combined use of a graphite and acetylene black is desirable. although especially the addition is not limited -- a negative electrode -- 1 - 50% of the weight of a mixture is desirable, and 2 - 30 % of the weight is especially desirable In carbon or especially a graphite, 2 - 15 % of the weight is desirable. Moreover, SnO<sub>2</sub> As Sb was made to dope, when electronic conductivity is given to the precursor of an electrode active material, an electric conduction agent can be reduced. In this case, 0 - 10 % of the weight is desirable.

[0017] In the constituted cell, a filler can be used anything, if it is the fibrous material which does not cause a chemical change. Usually, fiber, such as olefin system polymers, such as polypropylene and polyethylene, glass, and carbon, is used. although especially the addition of a filler is not limited -- a negative electrode -- 0 - 30% of the weight of a mixture is desirable

[0018] The manufacture technique of this invention produces the thickener solution which the binding agent distributed, and is performed in this solution by supplying and carrying out the mulling variance of the above-mentioned negative-electrode active material and the above-mentioned electric conduction agent. This variance and mulling variance can be performed using the disperser shown for example, in aforementioned drawing 1 . As a disperser used for the above-mentioned mulling variance, a level cylindrical shape mixer, a V type mixer, a double cone mixer, a paddle form mixer, a ribbonmixer, a sun-and-planet-motion form mixer, a screw form mixer, a high-speed flow type mixer, a level monopodium type kneading machine, and a level double shaft kneading machine can be mentioned. Specifically, a vertical form ribbon mixer, a broadside ribbon mixer, a vertical form screw mixer, a broadside screw mixer, a ball mill, a pin mixer, a double arm form kneader, a pressurized kneader, a Sand grinder, an omnipotent mixer, a gay mixer, a bead mill, and a \*\*\*\* paddle machine can be mentioned. Especially a ball mill is desirable. Even if it uses these dispersers independently, it may combine and they may use it. Moreover, in order to distribute a binding agent in a thickener solution, it is desirable to use a gay mixer and a bead mill.

[0019] the negative electrode obtained above -- a mixture and a positive electrode -- by applying to \*\*\*\*\* etc., a mixture creates an electrode (sheet) and creates a cell using the following electrolyte and a separator

[0020] Generally the electrolyte consists of a solvent and lithium salt (an anion and lithium cation) melted in the solvent. As a solvent, propylene carbonate, ethylene carbonate, butylene carbonate, Dimethyl carbonate, diethyl carbonate, gamma-butyrolactone, Methyl formate, methyl acetate, 1, 2-dimethoxyethane, a tetrahydrofuran, 2-methyl tetrahydrofuran,

dimethyl sulfoxide, 1, 3-dioxolane, A formamide, a dimethylformamide, a dioxolane, an acetonitrile, A nitromethane, an ethyl monochrome glyme, trialkyl phosphate (Provisional-Publication-No. 23973 [ 60 to ] official report), trimethoxy methane (Provisional-Publication-No. 4170 [ 61 to ] official report), and a dioxolane derivative (a Provisional-Publication-No. 15771 [ 62 to ] official report --) A Provisional-Publication-No. 22372 [ 62 to ] official report, a Provisional-Publication-No. 108474 [ 62 to ] official report, A sulfo run (Provisional-Publication-No. 31959 [ 62 to ] official report), 3-methyl-2-oxazolidinone (Provisional-Publication-No. 44961 [ 62 to ] official report), a propylene carbonate derivative (a Provisional-Publication-No. 290069 [ 62 to ] official report --) This 62 No. -290071 official report, a tetrahydrofuran derivative (Provisional-Publication-No. 32872 [ 63 to ] official report), Non-proton nature organic solvents, such as ethyl ether (Provisional-Publication-No. 62166 [ 63 to ] official report), 1, and 3-propane ape ton (Provisional-Publication-No. 102173 [ 63 to ] official report), can be mentioned, and these kinds or two sorts or more are mixed and used. As a cation of the lithium salt melted in these solvents For example, ClO<sub>4</sub>-, BF<sub>4</sub>-, PF<sub>6</sub>-, and CF<sub>3</sub> SO<sub>3</sub>-, CF<sub>3</sub> CO<sub>2</sub>-, AsF<sub>6</sub>-, SbF<sub>6</sub>-, and 2 (CF<sub>3</sub> SO<sub>2</sub>) N-, B10C11O2- (Provisional-Publication-No. 74974 [ 57 to ] official report), and 2 (1, 2-dimethoxyethane) ClO<sub>4</sub>- (Provisional-Publication-No. 74977 [ 57 to ] official report), Low-grade aliphatic carboxylic-acid ion (Provisional-Publication-No. 41773 [ 60 to ] official report), and AlCl<sub>4</sub>-, Cl-, Br-, and I- (Provisional-Publication-No. 247265 [ 60 to ] official report), The anion (Provisional-Publication-No. 165957 [ 61 to ] official report) of a \*\*\*\*\* borane compound and 4 phenyl boric-acid ion (Provisional-Publication-No. 214376 [ 61 to ] official report) can be mentioned, and these kinds or two sorts or more can be used. Especially, they are LiCF<sub>3</sub> SO<sub>3</sub>, LiClO<sub>4</sub>, and LiBF<sub>4</sub> to the mixed liquor of propylene carbonate or ethylene Cabot, 1 and 2-dimethoxyethane and/, or diethyl carbonate. And/or LiPF<sub>6</sub> The included electrolyte is desirable.

[0021] although especially the amount that adds these electrolytes in a cell is not limited -- the amount of a positive active material or a negative-electrode active material, and the size of a cell -- \*\*\*\* for initial complements -- things are made [0022] As a separator, it has big ion transmittance, and has a predetermined mechanical strength, and an insulating thin film is used. The sheet and nonwoven fabric which were built from organic-solvent-proof nature and the hydrophobic property from an olefin system polymer, a glass fiber, or polyethylene, such as a poly-pre pyrene, etc. are used. The domain for which the aperture of a separator is generally used as an object for cells is used. For example, 0.01-10 micrometers is used. Generally the thickness of \*\*\*\*\* is used in the domain for cells. For example, 5-300 micrometers is used.

[0023] If it is the electronic-conduction field which does not cause a chemical change in the constituted cell as \*\*\*\*\* of an electrode active material, it is good anything. For example, the thing which made the front face of copper or stainless steel else [, such as stainless steel, nickel, copper, titanium, aluminum, and baking carbon, ] process carbon, nickel, titanium, or silver, an aluminum-Cd alloy, etc. are used for the thing which made the front face of aluminum or stainless steel else [, such as stainless steel, nickel, aluminum, titanium, and baking carbon, ] process carbon, nickel, titanium, or silver as a material, and a negative electrode as a material in a positive electrode Oxidizing the front face of these materials is also used. As for a configuration, a film besides the foil, a sheet, the thing netted and punched, the lath field, the porous material field, a foam, the Plastic solid of a fiber group, etc. are used. Although especially thickness is not limited, a 1-500-micrometer thing is used.

[0024] The configuration of a cell can apply coin, a button, a sheet, a cylinder, an angle, etc. to all. At the time of coin or a button, the mixture of a positive active material or a negative-electrode active material is compressed into the configuration of a pellet, and the configuration of a cell is mainly used. The thickness and the diameter of the pellet are decided with the size of a cell. Moreover, when the configurations of a cell are a sheet, a cylinder, and an angle, on \*\*\*\*\* the mixture of a positive active material or a negative-electrode active material is applied, (coat) dried and compressed, and is mainly used. General technique can be used for a method of application. For example, the reverse-video rolling method, the direct rolling method, the blade method, the knife method, the extrusion method, the curtain method, the gravure method, the bar method, the dipping method, and the squeeze method can be mentioned. The blade method, the knife method, and the extrusion method are desirable. As for an application, it is desirable to carry out the speed for 0.1-100m/. In this case, it can double with the solution physical properties of a mixture, and a drying property, and the surface state of a good application layer can be obtained by selecting the above-mentioned method of application. Although the thickness, the length, and width of the application layer are decided with the size of a cell, the thickness of an application layer is in the status that it was compressed after dry, and especially its 1-2000 micrometers are desirable.

[0025] The technique generally adopted can be used as a pellet, or xeransis of a sheet or the dehydration technique. Especially, it is desirable independent or to combine and to use hot blast, a vacuum, infrared radiation, far infrared rays, an electron ray, and a damp wind. The domain of temperature of 80-350 degrees C is desirable, and its domain which is 100-250 degrees C is especially desirable. moisture content -- the cell whole -- 2000 ppm or less -- desirable -- a positive electrode -- a mixture and a negative electrode -- it is desirable to make it 500 ppm or less in a mixture or an electrolyte, respectively in respect of cycle nature Although the technique generally adopted can be used for a pellet or the method of pressing a sheet, a die-press method and its calender pressing method are especially desirable. Especially press \*\* is 2 0.2-3t/cm, although not limited. It is desirable. The press speed of the calender pressing method has the amount of desirable 0.1-50m/. Press temperature has desirable room temperature -200 degree C.

[0026] this -- a mixture -- a sheet is rolled or fractured, is inserted in a can, connects a sheet with a can electrically, pours in the electrolytic solution, and forms a cell can using an obturation plate At this time, a relief valve can be used as an obturation plate. It may be equipped with the various safe elements known from the former besides a relief valve. For example, a fuse, bimetal, PTC element, etc. are used as an overcurrent-protection element. Moreover, the technique, the gasket crack

technique, or the obturation plate crack technique of putting a cut into a cell can be used for the others of a relief valve as a cure of internal pressure elevation of a cell can. Moreover, you may make the circuit which built the surcharge and the cure against an overdischarge into the charge machine provide. The metal and alloy with electrical conductivity can be used for a can or a lead plate. For example, metals or those alloys, such as iron, nickel, titanium, chromium, molybdenum, copper, and aluminum, are used. Well-known technique (electric welding of an example, a direct current, or an alternating current, laser welding, ultrasonic welding) can be used for the welding process of a cap, a can, a sheet, and a lead plate. The compound and mixture which are known from the former, such as asphalt, can be used for the sealing compound for obturation.

[0027]

[Example] Although an example is raised below and this invention is explained still in detail, unless the main point of invention is exceeded, this invention is not limited to an example.

[0028] the disperser shown in [example 1] aforementioned drawing 1 -- using -- a negative electrode -- the mixture was produced In the pre variance tank 6, the water 50 weight section and the carboxymethyl-cellulose (CMC) 1 weight section are supplied, the stirring airfoil 8 for variance of the stirring machine 7 (gay mixer airfoil) is rotated, and CMC is melted in water. In this solution, supply the polyvinylidene-fluoride 2 weight section, rotated the stirring airfoil 8 for variance of the stirring machine 7 by 7000rpm, it was made to rotate for 2 hours, and the distributed liquid (200mPa and S, 25 degrees C) of a polyvinylidene fluoride was produced. this distributed liquid is moved to the distributed tank 4, the SiSnO3 43 weight section, the acetylene black 1 weight section, and the graphite 3 weight section are supplied further, and the stirring airfoil 3 (gay mixer airfoil) and the support airfoil 2 for variance of the stirring machine 1 are rotated by 7000rpm and 60rpm, respectively -- making -- 20 minute variance -- carrying out -- a negative electrode -- the mixture was obtained the obtained negative electrode -- the solid content of a mixture was 50 % of the weight, and apparent viscosities were 300mPas and S (25 degrees C)

[0029] this negative electrode -- on copper foil with a thickness of 20 micrometers, the \*\*\*\*\* type transfer pipet was used, and the mixture was applied, and was dried, and the negative electrode was produced In the spacing of a slot nozzle nose of cam and copper foil, width of face of 0.5mm and an entrance-side side outlet side lip side was performed by 0.1mm, and the bearer rate performed [ the application by the \*\*\*\*\* type transfer pipet ] 0.2mm and slot path clearance by part for 1m/.

[0030] except for having used the bead mill instead of the gay mixer, having made it rotate by 1300rpm, and the polyvinylidene fluoride having carried out distributed liquid (200mPa and S, 25 degrees C) \*\*\*\*\* as a stirring airfoil 8 for variance of the stirring machine 7, in the [example 2] example 1, -- an example 1 -- the same -- a negative electrode -- the mixture and the negative electrode were produced

[0031] In the [example 1 of comparison] variance tank 4, the water 50 weight section and the carboxymethyl-cellulose (CMC) 1 weight section are supplied, the stirring airfoil 3 for variance of the stirring machine 1 (gay mixer airfoil) is rotated, and CMC is melted in water. in this solution, the SiSnO3 43 weight section, the acetylene black 1 weight section, the graphite 3 weight section, and the polyvinylidene-fluoride 2 weight section are supplied, and the stirring airfoil 3 (gay mixer airfoil) and the support airfoil 2 for variance of the stirring machine 1 are rotated by 7000rpm and 60rpm, respectively -- making -- 20 minute variance -- carrying out -- a negative electrode -- the mixture was obtained the obtained negative electrode -- the solid content of a mixture was 50 % of the weight, and apparent viscosities were 300mPas and S (25 degrees C) the above -- the mixture was applied like the example 1 and the negative electrode was produced

[0032] The negative electrode (sheet) obtained in the above-mentioned example and the example of a comparison was evaluated as follows.

1) Negative-electrode sheet 1000cm2 The number of the binding agent aggregates which exist in a front face was counted by viewing. The number is shown. The above-mentioned result is shown in the following table.

[0033]

A table \*\*\*\*\* A binding agent aggregate

\*\*\*\*\* An example 1 0 An example 2 1

\*\*\*\*\* Example 1 of a comparison 42 \*\*\*\*\*

[0034]

[Effect of the invention] according to the technique of this invention -- a negative electrode -- without it reduces the viscosity of a mixture -- a negative electrode -- a mixture -- aggregates, such as an inner binding agent aggregate and a carbon aggregate, can be made to decrease sharply and the negative electrode obtained by this invention -- the rechargeable battery created using the mixture has an advantage that a charge-and-discharge life becomes long

[Translation done.]



## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## EXAMPLE

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\*\*\*\*\* An example 1 0 An example 2 1

\*\*\*\*\* Example 1 of a comparison 42 \*\*\*\*\*

[Translation done.]